

**AMENDMENTS TO THE SPECIFICATION**

**Please amend the Specification as follows. Insertions are shown underlined while deletions are ~~struck through~~.**

The paragraph beginning at page 4, line 8:

That is, this invention relates to a dicing/die-bonding film comprising a pressure-sensitive adhesive layer (2) on a supporting base material (1) and a die-bonding adhesive layer (3) on the pressure-sensitive adhesive layer (2),

wherein a releasability in an interface between the pressure-sensitive adhesive layer (2) and the die-bonding adhesive layer (3) is different between an interface (A) corresponding to a work-attaching ~~region portion~~ (3a) ~~in~~of the die-bonding adhesive layer (3) and an interface (B) corresponding to a part or a whole of the other ~~region portion~~ (3b),

and the releasability of the interface (A) is higher than the releasability of the interface (B).

The paragraph beginning at page 4, line 20:

In the dicing/die-bonding film I-(1), the adhesion of the pressure-sensitive adhesive layer (2) to the die-bonding adhesive layer (3) is different between a ~~region portion~~ (2a) corresponding to the work-attaching ~~region portion~~ (3a) ~~in~~of the die-bonding adhesive layer (3) and a ~~region portion~~ (2b) corresponding to a part or the whole of the other ~~region portion~~ (3b), and satisfies the relationship the adhesion of the pressure-sensitive adhesive layer at the portion (2a) is lower than the adhesion of the pressure-sensitive adhesive layer at the portion (2b).

The paragraph beginning at page 5, line 3:

The dicing/die-bonding film I-(1) of this invention comprises a pressure-sensitive adhesive layer (2) on a supporting base material (1) and a die-bonding adhesive layer (3) in a releasable manner on the pressure-sensitive adhesive layer (2). In the pressure-sensitive adhesive layer (2), the adhesion of ~~regions portions~~ (2a, 2b) corresponding to the work-attaching ~~region portion~~ (3a) and the other ~~region portion~~ (3b) respectively ~~in~~of the die-bonding adhesive layer (3) is designed such that the adhesion of the pressure-sensitive adhesive layer at the portion (2a) is lower than the adhesion of the pressure-sensitive adhesive layer at the portion (2b). That is, the pressure-sensitive adhesive layer at the portion (2b) adheres suitably to the adhesive layer (3)

- Appl. No.: 10/678,855  
Filing Date: October 3, 2003

during dicing step or expanding step, to prevent the adhesive layer (3) from being released from the pressure-sensitive adhesive layer (2). On the other hand, the pressure-sensitive adhesive layer at the portion (2a) can be easily released. Accordingly, a dicing/die-bonding film capable of easy release and pickup of a large chip of 10 mm×10 mm or more obtained as diced chipped work without inferior dicing can be obtained. Thus, the dicing/die-bonding film I-(1) according to this invention well balances retention during dicing step and releasability during pickup step.

The paragraph beginning at page 5, line 23:

In the dicing/die-bonding film I-(1), it is preferable that an adhesion of the work-attaching ~~region~~-portion (3a) ~~in~~of the die-bonding adhesive layer (3) to the work and to the pressure-sensitive adhesive layer at the portion (2a) satisfies the relationship:

the adhesion of the die-bonding adhesive layer (3) to the work is higher than the adhesion to the pressure-sensitive adhesive layer at the portion (2a).

The paragraph beginning at page 6, line 4:

When the adhesion of the die-bonding adhesive layer (3) to the work and to the pressure-sensitive adhesive layer at the portion (2a) satisfies this relationship, the die-bonding adhesive layer (3) arranged on the chipped work after dicing can be easily released from the pressure-sensitive adhesive layer at the portion (2a).

The paragraph beginning at page 6, line 9:

In the dicing/die-bonding film I-(1), the part of the ~~region~~-portion (3b) other than the work-attaching ~~region~~-portion (3a) ~~in~~of the die-bonding adhesive layer (3) can be used as a dicing ring-attaching ~~region~~-portion (3b'). In the dicing/die-bonding film I-(1), it is preferable that an adhesion of the dicing ring-attaching ~~region~~-portion (3b') ~~in~~of the die-bonding adhesive layer (3) to the dicing ring and to the pressure-sensitive adhesive layer at a portion (2b') corresponding to the portion (3b') satisfies the relationship:

the adhesion of the die-bonding adhesive (3) to the dicing ring is lower than the adhesion to the pressure-sensitive adhesive layer at the portion (2b').

The paragraph beginning at page 6, line 21:

Further, this invention relates to a dicing/die-bonding film comprising a pressure-sensitive adhesive layer (2) on a supporting base material (1) and a die-bonding adhesive layer (3) on the pressure-sensitive adhesive layer (2),

wherein the die-bonding adhesive layer (3) is arranged as a work-attaching region portion (3a) on a part of the pressure-sensitive adhesive layer (2), and

a region portion (2a) corresponding to the work-attaching region portion (3a) in of the pressure-sensitive adhesive layer (2) and the other region portion (2b) are different in adhesion and satisfy the relationship:

the adhesion of the pressure-sensitive adhesive layer at the portion (2a) is lower than the adhesion of the pressure-sensitive adhesive layer at the portion (2b).

The paragraph beginning at page 7, line 9:

The dicing/die-bonding film II-(2) of this invention comprises a pressure-sensitive adhesive layer (2) on a supporting base material (1) and a die-bonding adhesive layer (3) arranged as a work-attaching region portion (3a) in a releasable manner on a part of the pressure-sensitive adhesive layer (2). The pressure-sensitive adhesive layer (2) is designed such that the adhesion of the region portion (2a) corresponding to the work-attaching region portion (3a) and the adhesion of the other region portion (2b) satisfy the relationship: the adhesion of the pressure-sensitive adhesive layer at the portion (2a) is lower than the adhesion of the pressure-sensitive adhesive layer at the portion (2b). That is, the pressure-sensitive adhesive layer at the portion (2a) can be easily released. On the other hand, a wafer ring can be stuck on the pressure-sensitive adhesive layer at the portion (2b) and fixed such that it is not released during dicing step and expanding step. Accordingly, a dicing/die-bonding film capable of easy release and pickup of a large chip of 10 mm×10 mm or more obtained as diced chipped work without inferior dicing can be obtained. Thus, the dicing/die-bonding film II-(2) according to this invention well balances retention during dicing step and releasability during pickup step.

The paragraph beginning at page 8, line 4:

In the dicing/die bond (2), it is preferable that an adhesion of the work-attaching region portion (3a) to the work and to the pressure-sensitive adhesive layer at the portion (2a) satisfies the relationship:

the adhesion of the die-adhesive layer (3) to the work is higher than the adhesion to the pressure-sensitive adhesive layer at the portion (2a).

The paragraph beginning at page 8, line 9:

When the adhesion of the die-bonding adhesive layer at the portion (3a) to the work and to the pressure-sensitive adhesive layer portion (2a) satisfies the above relationship, the die-bonding adhesive layer portion (3a) arranged on the chipped work after dicing can be easily released from the pressure-sensitive adhesive layer at the portion (2a).

The paragraph beginning at page 8, line 14:

In the dicing/die-bonding films (1)I and (2)II, the pressure-sensitive adhesive layer (2) is formed preferably from a radiation-curing pressure-sensitive adhesive, and the pressure-sensitive adhesive layer at the portion (2a) corresponding to the work-attaching region portion (3a) can be formed by irradiation with radiations.

The paragraph beginning at page 8, line 20:

Further, this invention relates to a method of fixing a chipped work, comprising the steps of:

pressing a work onto a die-bonding adhesive layer portion (3a) in of the dicing/die-bonding film I or II-(1) or (2),  
dicing the work into chips,  
releasing the chipped work together with the die-bonding adhesive layer portion (3a) from the pressure-sensitive adhesive layer portion (2a) of the dicing/die bonding film, and  
fixing the chipped work to a semiconductor element via the die-bonding adhesive layer portion (3a).

The paragraph beginning at page 9, line 5:

Further, this invention relates to a semiconductor device comprising a chipped work fixed onto a semiconductor element via the die-bonding adhesive portion (3a) by the method of fixing a chipped work to a substrate or a chip.

The paragraph beginning at page 9, line 25:

In Fig. 1, the ~~regions~~-portions (2a, 2b) ~~in~~of the pressure-sensitive adhesive layer (2) are designed such that the releasability from the die-bonding adhesive layer (3) is in the relationship: the releasability of the interface (A) corresponding to the work-attaching ~~region~~-portion (3a) is higher than the releasability of the interface (B) corresponding to the other ~~region~~-portion (3b). The pressure-sensitive adhesive layer at the portion (2a) corresponds to the work-attaching ~~region~~-portion (3a) ~~in~~of the die-bonding adhesive layer (3), and the pressure-sensitive adhesive layer at the portion (2b) corresponds to the other ~~region~~-portion (3b).

The paragraph beginning at page 10, line 10:

Fig. 2 shows an example wherein the part of the ~~region~~-portion (3b) corresponds to the dicing ring-attaching ~~region~~-portion (3b'). That is, the releasability of the interface (B') between the dicing ring-attaching ~~region~~-portion (3b') and its corresponding pressure-sensitive adhesive ~~layer~~-portion (2b') is designed to be in the relationship: the releasability of the interface (A) is higher than the releasability of the interface (B'). In Fig. 1, the whole of the pressure-sensitive adhesive layer (2) except for the ~~pressure-sensitive adhesive layer~~-portion (2a) is the ~~pressure-sensitive adhesive layer~~-portion (2b), but as shown in Fig. 2, atthe part of the pressure-sensitive adhesive layer (2) except for the ~~pressure-sensitive adhesive layer~~-portion (2a) can also be the ~~pressure-sensitive adhesive layer~~-portion (2b).

The paragraph beginning at page 10, line 22:

Fig. 3 shows a sectional view of the dicing/die-bonding film (2)II of this invention that comprises a pressure-sensitive adhesive layer (2) on a supporting base material (1) and a work-attaching ~~region~~-portion (3a) on a part of the pressure-sensitive adhesive layer (2). The respective ~~regions~~-portions (2a, 2b) are designed such that the adhesion of the ~~region~~-portion (2a) corresponding to the work-attaching ~~region~~-portion (3a) and the adhesion of the other ~~region~~-portion (2b) ~~in~~of the pressure-sensitive adhesive layer (2) is in the relationship: the adhesion of the pressure-sensitive adhesive layer at the portion (2a) is lower than the adhesion of the pressure-sensitive adhesive layer at the portion (2b).

The paragraph beginning at page 11, line 24:

The material of the supporting base material includes polymers such as crosslinked resin. The plastic film may be non-stretched or may be subjected to uniaxial or biaxial stretching treatment if necessary. The resin sheet endowed with thermal shrinkage by stretching treatment can thermally shrink the supporting base material after dicing, whereby the contact area between the pressure-sensitive adhesive layer at the portion (2a) and the adhesive layer at the portion (3a) is reduced to facilitate recovery of the chipped work.

The paragraph beginning at page 13, line 3:

The pressure-sensitive adhesive used in formation of the pressure-sensitive adhesive layer (2) is not particularly limited, but is preferably a radiation-curing pressure-sensitive adhesive easily providing a difference in adhesion between the portion (2a) and the portion (2b) of the pressure-sensitive adhesive layers (2a) and (2b). The radiation-curing pressure-sensitive adhesive can easily lower the adhesion by increasing the degree of crosslinking upon irradiation with radiations such as UV rays. Accordingly, the radiation-curing pressure-sensitive adhesive layer fitted with the work-attaching region-portion (3a) can be cured to easily provide the portion (2a) of the pressure-sensitive adhesive layer (2a) with a significant reduction in adhesion. Because the adhesive layer (3) ~~or~~at the portion (3a) is stuck on the pressure-sensitive adhesive layer at the portion (2a) whose adhesion was reduced, the interface between the pressure-sensitive adhesive layer at the portion (2a) and the adhesive layer at the portion (3a) is inherently easily separated at the pickup step. On the other hand, the region not irradiated with radiations has sufficient adhesion, and forms the portion (2b) of the pressure-sensitive adhesive layer (2b).

The paragraph beginning at page 13, line 21:

In the dicing/die-bonding film (1)I, the portion (2b) of the pressure-sensitive adhesive layer (2b) made of the uncured radiation-curing pressure-sensitive adhesive adheres to the adhesive layer (3), thus maintaining retaining force at the dicing step. Thus, the radiation-curing pressure-sensitive adhesive can, with good balance between adhesion and release, support the die-bonding adhesive layer (3) for fixing a chipped work (semiconductor chip etc.) to an adherend (referred to as semiconductor element) such as a substrate and a chipped work. In the dicing/die-bonding film II-(2), the portion (2b) of the pressure-sensitive adhesive layer (2b) can fix a wafer ring etc.

The paragraph beginning at page 22, line 12:

If necessary, the radiation-curing pressure-sensitive adhesive layer (2) can also contain a compound to be colored by irradiation with radiations. By incorporating the compound colored by irradiation with radiations into the radiation-curing pressure-sensitive adhesive (2), only a region irradiated with radiations can be colored. That is, the pressure-sensitive adhesive layer at the portion (2a) corresponding to the work-attaching region at the portion (3a) can be colored. Accordingly, whether the pressure-sensitive adhesive layer (2) has been irradiated with radiations can be immediately judged with the naked eye, and the work-attaching region portion (3a) can be easily recognized to facilitate attachment to a work. Further, when the resulting semiconductor element is detected by an optical sensor etc., the detection accuracy is improved, thus preventing erroneous working in pickup of the semiconductor element.

The paragraph beginning at page 23, line 2:

The compound to be colored with irradiation with radiations may be first dissolved in an organic solvent etc. and then incorporated into the radiation-curing pressure-sensitive adhesive, or may be first pulverized finely and then incorporated into the pressure-sensitive adhesive. The ratio of this compound used is 10% or less by weight, preferably 0.01 to 10% by weight, more preferably 0.5 to 5% by weight, based on the pressure-sensitive adhesive layer (2). When the ratio of the compound is higher than 10% by weight, too much radiation applied to the pressure-sensitive adhesive layer (2) is adsorbed into this compound, and therefore the pressure-sensitive adhesive layer at the portion (2a) is hardly cured, thus failing to lower adhesion sufficiently. For sufficient coloration, on the other hand, the ratio of the compound is preferably 0.01% or more by weight.

The paragraph beginning at page 24, line 8:

The pressure-sensitive adhesive layer (2) is arranged such that the adhesion of the pressure-sensitive adhesive layer at the portion (2a) is lower than the adhesion of the pressure-sensitive adhesive layer at the portion (2b). In the dicing/die-bonding film I-(1), the adhesion to the die-bonding adhesive layer (3) is determined such that the releasability of the interface (A) is higher than the releasability of the interface (B). In the dicing/die-bonding film (2)II, the

adhesion of the pressure-sensitive adhesive layer at the portion (2a) to an SUS304 plate (#2000 polishing) as an adherend is lower than the adhesion of the pressure-sensitive adhesive layer at the portion (2b) to the plate.

The paragraph beginning at page 24, line 18:

In the case where the pressure-sensitive adhesive layer (2) is formed from a radiation-curing pressure-sensitive adhesive, mention is made of a method wherein the radiation-curing pressure-sensitive adhesive layer (2) is formed on the supporting base material (1), a region portion corresponding to the work-attaching region portion (3a) is cured by partial irradiation with radiations, to form the portion (2a) of the pressure-sensitive adhesive layer (2a). The partial irradiation with radiations can be carried out via a photomask having a pattern corresponding to the region portion (3b etc.) other than the work-attaching region portion (3a). Mention is also made of a method of curing the pressure-sensitive adhesive layer by spot irradiation with UV rays. Formation of the radiation-curing pressure-sensitive adhesive layer (2) can be carried out by transferring the layer arranged on a separator to the supporting base material (1). The radiation-curing pressure-sensitive adhesive layer (2) arranged on the separator may be subjected to partial curing with radiations.

The paragraph beginning at page 25, line 9:

Alternatively, when the pressure-sensitive adhesive layer (2) is formed from a radiation-curing pressure-sensitive adhesive, use can be made of a method wherein the supporting base material (1), at least one side of which is light-shielded except for the whole or a part of a region portion corresponding to the work-attaching region portion (3a), is provided with the radiation-curing pressure-sensitive adhesive layer (2) and then cured in the region corresponding to the work-attaching region portion (3a) to form the portion (2a) of the pressure-sensitive adhesive layer (2a) whose adhesion is lowered. Printing or depositing a material capable of serving as a photomask on the supporting film can produce the light-shielding material. According to such production method, the dicing/die-bonding film of this invention can be efficiently produced.

The paragraph beginning at page 26, line 10:

When a work (semiconductor wafer etc.) contact-bonded onto the die-bonding adhesive layer (3) is diced into chips, the adhesive layer (3) adheres to and supports the work, and when the chipped work formed into cut fragment (semiconductor chip etc.) is to be mounted, the adhesive layer works for fixing the chipped work to a semiconductor element (substrate, chip etc.). It is particularly important that the die-bonding adhesive layer (3) has such adhesion as not to scatter cut fragments during dicing of the work. In the dicing/die-bonding film (2)II, the die-bonding adhesive layer (3) is arranged in the previously formed work-attaching region portion (3a).

The paragraph beginning at page 29, line 11:

In the dicing/die-bonding film (1)I, the adhesion of the pressure-sensitive adhesive layer (2) to the die-bonding adhesive layer (3) is designed such that the adhesion of the pressure-sensitive adhesive layer at the portion (2a) is lower than the adhesion of the pressure-sensitive adhesive layer at the portion (2b). On the basis of the adhesion (90° peel value, peel rate 300 mm/min.) at ordinary temperature (23°C), the adhesion of the pressure-sensitive adhesive layer at the portion (2a) is preferably not higher than 0.5 N/20 mm, more preferably 0.01 to 0.42 N/20 mm, still more preferably 0.01 to 0.35 N/20 mm from the viewpoint of retention of a wafer or recovery of formed chips. On the other hand, the adhesion of the pressure-sensitive adhesive layer at the portion (2b) is preferably about 0.5 to 20 N/20 mm. Even if the pressure-sensitive adhesive layer at the portion (2a) has low peel adhesion, the adhesion of the pressure-sensitive adhesive layer at the portion (2b) can prevent chips from being scattered, and can demonstrate sufficient retention for processing of wafers.

The paragraph beginning at page 30, line 2:

In the dicing/die-bonding film (2)II, the region portion (2a) corresponding to the work-attaching region portion (3a) and the other region portion (2b) in of the pressure-sensitive adhesive layer (2) are designed such that the adhesion of the pressure-sensitive adhesive layer at the portion (2a) is lower than the adhesion of the pressure-sensitive adhesive layer at the portion (2b). The adhesion of the pressure-sensitive adhesive layer at the portion (2a) to the work-attaching region portion (3a) (under the same conditions as described above) is not higher than

0.5 N/20 mm, more preferably 0.01 to 0.42 N/20 mm, and still more preferably 0.01 to 0.35 N/20 mm.

The paragraph beginning at page 30, line 12:

In the dicing/die-bonding films (1)I and (2)II, the adhesion of the work-attaching region portion (3a) to the work and to the pressure-sensitive adhesive layer at the portion (2a) is desired preferably such that the adhesion to the work is higher than the adhesion to the pressure-sensitive adhesive layer at the portion (2a). The adhesion to the work is regulated suitably depending on the type of the work.

The paragraph beginning at page 30, line 18:

As described above, the adhesion of the work-attaching region portion (3a) to the pressure-sensitive adhesive layer at the portion (2a) (under the same conditions as described above) is not higher than 0.5 N/20 mm, more preferably 0.01 to 0.42 N/20 mm, and still more preferably 0.01 to 0.35 N/20 mm. On the other hand, the adhesion of the work-attaching region portion (3a) to the work (under the same conditions as described above) is not higher than 10 to 50 N/20 mm, more preferably 10 to 30 N/20 mm, from the viewpoint of pickup and reliability at the time of dicing, pickup, and die-bonding.

The paragraph beginning at page 31, line 3:

When the region portion (3b) other than the work-attaching region portion (3a) is used as the dicing ring-attaching region portion (3b') in the dicing/die-bonding film (1)I, the adhesion of the dicing ring-attaching region portion (3b') ~~is of~~ the die-bonding adhesive layer (3) to the work and to the pressure-sensitive adhesive layer at the portion (2b') is designed preferably such that the adhesion to the dicing ring is lower than the adhesion to the pressure-sensitive adhesive layer at the portion (2b'). The adhesion to the dicing ring is regulated suitably depending on the type of the dicing ring.

The paragraph beginning at page 31, line 12:

As described above, the adhesion of the die-bonding adhesive layer (3) to the pressure-sensitive adhesive layer at the portion (2b') (under the same conditions as described above) is

preferably about 0.5 to 20 N/20 mm. On the other hand, the adhesion of the die-bonding adhesive layer (3) to the dicing ring is preferably 0.3 to 5 N/20 mm, more preferably 0.5 to 5 N/20 mm, from the view point of workability at the time of dicing and die-bonding.

The paragraph beginning at page 31, line 19:

In the dicing/die-bonding films (1)I and (2)II, the die-bonding adhesive layers (3) and the die-bonding adhesive portion (3a) may be protected with a separator (not shown in drawings). That is, a separator may be arbitrarily arranged. The separator functions as a protecting material protecting the die-bonding adhesive layers (3) and the die-bonding adhesive portion (3a). Further, the separator can also be used as a supporting base material for transferring the die-bonding adhesives of the die-bonding adhesive layer (3) and the die-bonding adhesive portion (3a) to the pressure-sensitive adhesive layer (2). The separator is removed just before a work is stuck on the die-bonding adhesive layer (3) or the die-bonding adhesive portion (3a) in the dicing/die-bonding film (1)I or (2)II. The separator includes a polyethylene or polypropylene film or a plastic film and paper coated with a releasing agent such as fluorine releasing agent or a long chain alkyl acrylate releasing agent.

The paragraph beginning at page 32, line 7:

After the separator arranged arbitrarily on the adhesive layer (3) or the die-bonding adhesive portion (3a) is removed, the dicing/die-bonding film (1)I or (2)II of this invention is used in the following manner. That is, a work is pressed to the die-bonding adhesive layer portion (3a) in the dicing/die-bonding film (1)I or (2)II, and the work is adhesive-bonded to the adhesive layer portion (3a). This pressing is carried out in a usual manner. The work used in this invention is preferably a semiconductor wafer. Then, the work is diced into chips. The work includes, for example, a semiconductor wafer, a multi-layer substrate, a simultaneously sealed module etc. The work used in this invention is preferably a semiconductor wafer. By dicing, the work having the adhesive layer (3) is formed into chipped works (semiconductor chips etc.) by suitable means using a rotating circular tooth.

The paragraph beginning at page 32, line 21:

The chipped work together with the die-bonding adhesive layer-portion (3a) is then released from the pressure-sensitive adhesive layer at the portion (2a). The chipped work thus picked up is adhesive-bonded via the die-bonding adhesive layer-portion (3a) to a semiconductor element as an adherend. The semiconductor element includes a lead frame, a TAB film, a substrate or a separately prepared chipped work. For example, the adherend may be a deformed adherend to be easily deformed, or a hardly deformable non-deformed adherent (semiconductor wafer etc.). The adherend is preferably a semiconductor wafer. When the adhesive layer (3) or the die-bonding adhesive portion (3a) is thermosetting, the work is adhesive-bonded to an adherend by thermosetting, to improve heat resistance. For example, the chipped work adhesive-bonded to a substrate via the adhesive layers-portion (3a) can be subjected to a reflow process.

The abstract on page 51:

A dicing/die-bonding film including a pressure-sensitive adhesive layer (2) on a supporting base material (1) and a die-bonding adhesive layer (3) on the pressure-sensitive adhesive layer (2), wherein a releasability in an interface between the pressure-sensitive adhesive layer (2) and the die-bonding adhesive layer (3) is different between an interface (A) corresponding to a work-attaching region-portion (3a) ~~in~~<sup>of</sup> the die-bonding adhesive layer (3) and an interface (B) corresponding to a part or a whole of the other region-portion (3b), and the releasability of the interface (A) is higher than the releasability of the interface (B). The dicing/die-bonding film is excellent in balance between retention in dicing a work and releasability in releasing its diced chipped work together with the die-bonding adhesive layer.